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## New Reissue claims for U.S. Patent No. 5,851,172

42. An apparatus for advancing a radioactive source into a patient, the apparatus comprising:
(a) a housing adapted to receive a catheter and adapted for storing a radioactive source;
(b) a drive for advancing the radioactive source from the housing into a catheter;
(c) a force sensor for detecting the force applied to advance the radioactive source in a catheter and for generating an output signal indicative of said force.

43. The apparatus of claim 42, further comprising an elongated carrier, wherein said radioactive material is secured on a portion of said elongated carrier.

44. The apparatus of claim 43, wherein said elongated carrier is a column adapted to be pushed into a catheter.

45. The apparatus of claim 44, further comprising a storage tube mounted to said housing and having an opening proximal to said drive.

46. The apparatus of claim 43, wherein said drive engages and drives said elongated carrier to advance the radioactive source.

47. The apparatus of claim 46 wherein said drive comprises a cylindrical disk having a single groove of one revolution disposed on an outer surface thereof, said disk being rotated about an axis thereof, said groove adapted for receiving said elongated carrier and advancing said radioactive source into a catheter, said elongated carrier contacting said groove for at least about 10 degrees of arc.

48. The apparatus of claim 47 further including a guide tube for preventing buckling of said column.

49. The apparatus of claim 48, said guide tube having an open end fixed at a point proximal to a point where said column exits said groove tangent to said cylindrical disk as said column is advanced into a catheter.

50. The apparatus of claim 48, further including: a second guide tube for preventing buckling of said column.

51. The apparatus of claim 47 further including a biasing element for urging said elongated carrier against said groove.

52. The apparatus of claim 46, wherein said drive is secured to said housing by a pivotal attachment and said force sensor comprises a load cell mounted along the axis of said elongated carrier exiting said drive as it is advanced toward a catheter.

53. The apparatus of claim 52 wherein said pivotal attachment is substantially along the axis of said elongated carrier entering said drive mechanism as it is advanced toward a catheter.

54. The apparatus of claim 43, wherein said radioactive material is located on a distal portion of said elongated carrier.

55. The apparatus of claim 43, wherein said force sensor engages and detects the force applied to said elongated carrier.

56. The apparatus of claim 43, further comprising an encoder for determining displacement of said elongated carrier and for generating an output signal indicative of said displacement.

57. The apparatus of claim 56, further comprising an electronic control system responsive to the signals from said force sensor and from said encoder for controlling advancement of said radioactive source into and out of a catheter.

58. The apparatus of claim 57, wherein said control system is responsive to said output signal of the force sensor to arrest advancement of said radiation source when said output signal exceeds a predetermined value or rate of change.

59. The apparatus of claim 57, wherein said control system includes an updating system for interrogating the output signal generated by the force sensor at predetermined intervals of displacement of the radiation source or at predetermined time intervals.

60. The apparatus of claim 57, further including a catheter scanner for reading catheter information associated with a catheter, said electronic control system controlling advancement of said elongate lead into and out of said catheter responsive to said catheter information.

61. The apparatus of claim 43, further comprising a substantially cylindrical storage drum positioned to receive turns of said elongated carrier, said drum having an outer cylindrical surface and being rotated about an axis.

62. The apparatus of claim 61, further including a drum indexer for displacing said drum along said axis responsive to rotation of said drum for urging the turns of said elongated carrier to wind flat against said drum without overlapping.

63. The apparatus of claim 62 further including a biasing element for urging said elongated carrier against said outer cylindrical surface of said drum.

64. The apparatus of claim 63 wherein said biasing element comprises a plurality of capstans.

65. The apparatus of claim 64 wherein said biasing element comprises an endless belt disposed between said plurality of capstans and the outer cylindrical surface of said drum.

66. The apparatus of claim 42, further comprising an encoder for determining displacement of said radioactive source and for generating an output signal indicative of said displacement.

67. The apparatus of claim 42, wherein said housing has a storage area for storing said radioactive source.

68. The apparatus of claim 67, wherein said radioactive source and said storage area are housed in a separate unit that is readily detachable from said housing.

69. The apparatus of claim 68, wherein at least a portion of said drive is housed in said separate unit.

70. The apparatus of claim 42, wherein a catheter is slidably attached to said housing and said force sensor comprises a load cell adapted to sense a force tending to displace the catheter.

71. The apparatus of claim 42 further including a direction changing capstan, said direction changing capstan slidably mounted to said housing and wherein said force sensor comprises a load cell adapted to sense a force tending to displace said direction changing capstan.

72. The apparatus of claim 42 further including a catheter receiver for storing a plurality of catheters.

73. The apparatus of claim 42, adapted for use with a catheter having associated coded catheter information, further comprising a scanner for reading catheter information.

74. The apparatus of claim 73, further comprising an electronic control system receiving and responding to catheter information by controlling the advancement of said radioactive source into and out of the catheter having associated coded catheter information.

75. The apparatus of claim 73, wherein said housing has a catheter receiver to receive a catheter and said scanner is incorporated into said catheter receiver.

76. The apparatus of claim 73, wherein the scanner is a bar code reader for reading catheter information including a bar code.

77. The apparatus of claim 73 wherein the scanner is a semiconductor chip reader for reading catheter information on a chip associated with a catheter.

78. The apparatus of claim 73, wherein said catheter information includes at least one of the following items of information: the type of catheter, the catheter length, whether the catheter has a balloon, the catheter balloon length, the location of the catheter balloon along the length of the catheter, and an inventory control number.

79. The apparatus of claim 42, said housing further including a radiation safe for storing said radioactive source when not in use.

80. The apparatus of claim 79, further including a radiation sensor associated with said housing for verifying the location of said radiation source within or without said radiation safe.

81. The apparatus of claim 42, further comprising a shield external to said housing and an external radiation sensor for verifying the radioactive integrity of said shield.

82. The apparatus of claim 42, further comprising a catheter connected to said housing.

83. The apparatus of claim 43, wherein said force sensor engages and detects the force applied to said elongated carrier.

84. The apparatus of claim 51 wherein said biasing element comprises a plurality of capstans adjacent to said outer circumferential surface of said cylindrical disk for retaining said elongate lead in said groove.

85. The apparatus of claim 84, wherein said biasing element further comprises an endless belt disposed between said plurality of capstans and said outer circumferential surface of said cylindrical disk.

86. The apparatus of claim 50, said second guide tube having an open end fixed at a point proximal to a point where said column exits said groove tangent to said cylindrical disk as said column is retracted from a catheter and conveyed to said housing for storing said radioactive source.

87. The apparatus of claim 42 wherein said force sensor includes a monitoring feature for monitoring a characteristic of said drive for advancing said radioactive source into a catheter.

88. The apparatus of claim 87 wherein said drive includes an electric motor and said monitoring feature measures the current supplied to said drive motor.

89. An apparatus for advancing a radioactive source into a catheter implanted in the body of a patient comprising

(a) a housing,

(b) a radioactive source,

(c) a modular cassette adapted for storing said radioactive source;

(d) a coupling for removably attaching said modular drive cassette to said housing for ready replacement of the cassette with another cassette having a different radioactive source; and

(e) a drive for advancing the radioactive source from said cassette into a catheter.

90. The apparatus of claim 89, wherein said radioactive source is a source of beta radiation.

91. A method of advancing a radioactive source to a target site in the body of a patient, comprising:

(a) providing a radioactive source;

(b) storing the radioactive source in a radiation-proof safe;

(c) implanting a catheter in the patient with a distal portion of the catheter at or near the target site;

(d) advancing the radioactive source from the safe into the catheter to said distal portion;

(e) detecting the magnitude of the force exerted on the radioactive source during advancement of the radioactive source in the catheter;

(f) responding to feedback of the magnitude of the detected exerted force to maintain the exerted force within a maximum force limit;

(g) maintaining the radioactive source at said distal portion to irradiate said target site; and

(h) retracting the radioactive source into the safe after said maintaining step.